FIRST STATISTICAL REPORT OF THE RADIATION THERAPY DEPARTMENT OF THE JOHANNESBURG GROUP OF HOSPITALS

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This is the fourth article in the series dealing with malignant disease in the Transvaal, as seen in the Radiation Therapy Department of the Johannesburg Hospital. The following systems have already been analysed: skin,[1] muscular and skeletal system, respiratory tract,[2] vascular system, haemopoietic and reticulo-endothelial system, and alimentary tract.[3]

In the previous articles in this series important racial differences were noted, and the same has been found in this analysis of malignancy in the genito-urinary system.

The cases of tumour of the genito-urinary system referred to the radiotherapy department during the 10 years 1949 - 58 are classified in Tables I and II. The analysis in this article is largely based on the figures in these tables.

CARCINOMA OF THE OVARY

A total of 186 cases of ovarian cancer were referred for radiotherapy during the 10-year period. Of these, 152 occurred among Europeans, and 34 among Bantu patients. The European predominance in ovarian cancer contrasts markedly with other genito-urinary tumours, notably carcinoma of the cervix, which is far commoner in African women (Table I).

More than 75% of the European cases occurred in the 5th, 6th and 7th decades. Dysgerminoma and teratoma, however, occurred in younger patients, aged from 6 years to 25 years. In the non-European series 74% occurred in the 3rd, 4th and 5th decades, thus confirming the general tendency towards a younger age susceptibility in the Bantu. (Table II.)

Pathology. By far the commonest malignant ovarian tumour was the papillary serous cystadenocarcinoma, which accounted for 66% of the total. Next commonest was malignant pseudomucinous cystadenoma, which was present in 18% of the cases. 'Miscellaneous' malignant tumours, including dysgerminoma, teratoma, granulosa-cell tumour,

TABLE I. TUMOURS OF THE GENITO-URINARY SYSTEM BY SITE, PATHOLOGY, RACE AND SEX

Organ	*Pathology*		*Eur.*	*Afr.*	*Total*
Ovary	Serous cystadenocarcinoma		100	23	123
	Pseudomucinous cystadenocarcinoma		28	6	34
	Miscellaneous ovarian tumours		24	5	29
Uterus (body)	Adenocarcinoma		80	17	97
	Chorionepithelioma		1	1	2
Cervix	Squamous carcinoma		305	540	845
	Anaplastic tumours		21	52	73
	Adenocarcinoma		13	30	43
Vagina	Squamous carcinoma		2	2	4
Vulva	Squamous carcinoma		8	4	12
Mesenchyme	'Sarcoma'		14	5	19
Testis	Seminoma		18	6	24
	Teratocarcinoma		17	2	19
	Chorionepithelioma		2	0	2
Penis	Squamous-cell carcinoma		13	34	47
Kidney	Nephroblastoma	M	6	12	44
		F	6	20	
	Adenocarcinoma	M	32	8	62
		F	17	5	
Bladder	Papillary carcinoma	M	42	2	56
		F	10	2	
	Transitional-cell carcinoma	M	56	5	72
		F	11	0	
	Squamous-cell carcinoma	M	17	13	36
		F	4	2	
Total			847	796	1,643

* The previous articles in this series were published in this *Journal* of 22 November 1952, 29 January 1955, and 29 June 1957. This is expected to be the penultimate article in the series.

TABLE II. DISTRIBUTION BY SITE, RACE AND AGE

Age	Ovary		Uterus		Cervix		Testis		Penis		Kidney		Bladder		Total		
	Eur.	Afr.	Eur.	Afr.	Eur.	Afr.	Eur.	Afr.	Eur.	Afr.	Eur.	Afr.	Eur.	Afr.	Eur.	Afr.	Total
0 - 9	1	1	—	—	—	—	1	—	—	—	12*	30*	—	—	14	31	45
10 - 19	2	3	—	—	—	1	1	1	—	—	—	2*	—	—	3	7	10
20 - 29	9	4	—	—	7	14	7	1	—	1	1	2	—	1	24	23	47
30 - 39	12	10	4	—	48	174	15	4	—	6	3	4	4	6	86	204	290
40 - 49	31	9	6	—	81	187	11	1	2	9	13	3	12	10	156	219	375
50 - 59	42	3	19	4	97	117	0	—	1	9	16	1	17	5	192	139	331
60 - 69	39	0	33	5	71	75	1	—	5	7	8	3	44	1	201	91	292
70 - 79	5	1	18	1	21	24	0	—	4	—	5	—	46	1	999	27	126
80+	1	—	1	—	3	5	1	—	1	—	1	—	5	—	13	5	18
															787	747	1,534
Mean Age	52·0	36·9	62·2	62·0	52·7	47·6	36·9	32·1	65·8	49·7	56·4	43·2	65·2	45·9			

*These 44 cases excluded from calculated averages.

chorionepithelioma, and malignant degeneration in endometriomas, together constituted 8% of the series. A wide variety of tumours were classified as 'adenocarcinoma', or 'anaplastic carcinoma', which were mainly solid, and of indeterminate origin, deriving in all probability from silent growths elsewhere, and these accounted for the remaining 8% of cases (Table I).

Stage. The majority of cases were classified as 'late', owing to the tendency of these tumours to widespread dissemination throughout the peritoneal cavity. Gross local involvement of omentum, pelvic organs, metastatic glands and ascites were often concomitant features. Thus in many cases, owing to poor general condition, palliative therapy only was administered.

Treatment

Although the treatment of malignant disease of the ovary is primarily surgical, cases were referred to the radiotherapy department under the following circumstances: After complete removal of an ovarian tumour, proved on histological examination to be malignant; after primary incomplete surgery, with either residual tumour, rupture of cyst contents, or visible metastases in glands or liver; inoperable tumour, either clinically or at laparatomy; or for recurrence after surgery.

Regional X-ray therapy was administered whenever feasible, and field sizes adequate to subtend the macroscopic tumour-bearing area were prescribed. The dosage levels were generally of the order of 3,500 r in 4 weeks, if the disease did not extend beyond the pelvic brim; or 3,000 r in 4 weeks if the field extended to the level of the umbilicus; or somewhat smaller doses if the whole abdomen required irradiation. X-ray therapy was supplemented in certain cases by intraperitoneal radio-active colloid, 150 - 200 mc. of Au-198, or 10 - 15 mc. of colloidal P-32 (ziconium phosphate), as well as by intra-uterine and vaginal radium.

Encouraging results were evident in the 'early' cases, and in the 'late' cases marked growth restraint was achieved, together with worth-while palliation. One patient with widespread peritoneal dissemination is known to be alive and well after 5 years. The control of ascites for long periods by intraperitoneal radio-active colloid and nitrogen mustard was also achieved. Owing to poor follow-up and variation in natural history, it has been difficult to assess the survival rate in relation to the various therapeutic procedures.

CANCER OF THE UTERUS (BODY)

During the same period, 97 cases of carcinoma of the body of the uterus were referred to the radiotherapy department, of which 80 were Europeans and 17 Africans (Table I). Of the cases treated, 88% were over 50 years of age, in contrast to carcinoma of the cervix (Table II). There was no racial difference in age distribution, an unusual feature in view of the findings in other regions. With the exception of 2 chorionepitheliomas, the histological picture was invariably that of adenocarcinoma.

In the 'operable' cases primary surgery was generally accepted as the treatment of choice, particularly when fibroids or adnexal masses were present.

Cases were referred for radiotherapy under the following circumstances: patients regarded as poor-risk cases owing to old age, obesity, diabetes or hypertension, in which radium therapy proved to be a safe alternative method of curative treatment; for post-operative vaginal radium, to reduce the incidence of vaginal recurrence; for overt recurrence in the vagina and pelvic tissues; or for malignant ascites.

The method of primary radical treatment consisted of the introduction of radium in rubber containers, arranged to form a single linear source from the fundus of the uterus to the upper half of the vagina, delivering a dose of 10,000 r to the paracervical regions in about 10 days. For post-operative therapy, vaginal radium in the form of one or two ovoids were applied so as to deliver a dose of 6,000 r to the mucosa in 48 hours.

When the adenocarcinoma was found to be confined to the lowest portion of the uterus or the endocervical canal, with or without parametrial spread, a similar technique to that for carcinoma of the cervix was carried out.

The results of radium treatment of early cases of carcinoma of the body of the uterus have been excellent.

CARCINOMA OF THE CERVIX

During the 10-year period 961 cases of carcinoma of the cervix were referred for treatment, 339 Europeans and 622 Bantu. These figures indicate the extraordinary susceptibility of Bantu women to cancer in this site. It is by far the largest single group of tumours in our whole series, and although the proportion of Bantu patients presenting for treatment is little more than one-third of the total for neoplasms in all sites, they outnumber the European by almost 2 : 1 in this particular tumour. This is in sharp contrast with adeno-

carcinoma of the body of the uterus, where 82% of cases were Europeans (Table I).

The number of European cases referred during these 10 years has remained fairly constant, approximately 35 cases per year, but there has been a marked increase in the number of Bantu cases during the past 3 years, from 35 to 105 per year. Although this threefold increase in cases attending was not observed in any other tumour, with the exception of oesophageal cancer, it can probably be explained in part by the fact that a larger proportion of these cases are now attending hospitals.

There was little difference in the average age in the two race groups, viz. 53 years for Europeans and 48 years for Bantu (Table II).

A definite histological report was obtained in almost all cases, and of these 88% were squamous cancer, 7·6% anaplastic tumours, and 4·5% adenocarcinoma, the percentages of each type being similar in the two races (Table I).

The European patients sought advice at an earlier stage of the disease, 53% being classified as stage I or II, and only 27% as stage III, as compared with 34% stage I or II, and 46% stage III in the Bantu. In both races 20% of cases were classified as stage IV.

Treatment

Nearly all the European patients were treated primarily in the gynaecology departments, either surgically (12%) or with radium applications, and then referred for radiation therapy. The radium was applied either according to the Stockholm technique, or the modified Manchester method.

The Bantu cases all received the full course of treatment in the radiation therapy department, with the exception of 16 patients (2·6% of the total) who had undergone some surgical procedure first. The routine method of radium application was a modified Manchester technique, delivering about 7,000 r to the paracervical tissues in a continuous exposure over 6 days. This was the sole form of treatment in stage I and early stage II cases, and was combined with 'multiple-field beam-directed' X-ray therapy in late stage II, stage III and occasionally stage IV cases. Radical treatment was administered to 80% of the total number of patients.

Since 1957 intra-arterial chemotherapy combined with radiation therapy has been used in treating inoperable recurrent cases of cancer of the cervix. Re-irradiation of patients was reported by Murphy and Schmitz[4] and others, with a certain degree of success, and it was felt that in combination with intra-arterial nitrogen-mustard, it might prove of even greater value. The technique employed was as follows: A polythene catheter was inserted into the femoral artery under a local anaesthetic, and pushed cranially, to enable nitrogen-mustard to be injected into the aorta just above its bifurcation. In some of our earlier cases the catheter remained in position for 4 days, 10 mg. of nitrogen-mustard being injected daily, but it was later found more satisfactory to inject the whole quantity at the rate of 10 mg. every ½ hour. In the more recent cases tourniquets were applied to both thighs during the injections. No untoward effects were encountered, apart from vomiting in 1 patient, and the haemoglobin and leukocyte levels remained fairly constant. A repeat course of radium therapy (5,500 r) was given 1 - 2 weeks after the injections, followed by external X-ray therapy only if the latter had not previously been administered.

Of the 17 very advanced cases (15 Bantu and 2 European) treated in this way, 8 are alive, 8 dead, and 1 not traced. Of the 8 living patients, 2 have survived over 18 months, are well, and have returned to work. Another is known to be well after 9 months. One treated 6 months previously, developed a vesico-vaginal fistula, which required surgery with construction of an ileal bladder, but remains fairly well at the present time. The other 4 patients have only been treated within the last 3 months. Of the patients who died, 7 showed advanced cancer at autopsy with involvement of pelvic organs and lymph glands. One patient, who died of intercurrent disease 1 month after the combined therapy with nitrogen-mustard and a moderate dose of X-rays, showed no macroscopic evidence of tumour at post-mortem examination.

CARCINOMA OF THE VAGINA

This is an exceedingly uncommon tumour, there being only 4 cases in our series. Two were African women in their third decade, and 2 were Europeans aged 35 and 70 years respectively. All were squamous-cell cancer, associated in one of the African women with bilharzia (Table I).

CARCINOMA OF THE VULVA

During the 10 years a total of 12 cases of carcinoma of the vulva were encountered, 8 in Europeans, 4 in Africans. Of the European patients 7 were over the age of 60, and 1 aged 50. The African cases were younger, 1 aged 30, 2 aged 40, and 1 aged 50. Nine were squamous carcinomas, 2 were anaplastic tumours, and 1 was a basal-cell carcinoma (Table I).

The paucity of cases referred for radiotherapy is due primarily to the rarity of this disease, and secondarily to the fact that this tumour responds unfavourably to radiotherapy. As the growth commonly arises upon a precancerous area of leukoplakia with a tendency towards multiple foci of origin, surgery (total vulvectomy) was the treatment of choice.

MESENCHYMAL TUMOURS OF FEMALE GENITAL TRACT

There were 19 cases of pelvic tumours reported as 'sarcoma', 14 in Europeans and 5 in African women (Table I). Of these, 14 were sarcomata of uterine muscle, and 3 arose in the cervix, 1 in the ureter and 1 in the ovary. The majority of cases, in both racial groups, appeared in the 5th decade.

MALIGNANT TUMOURS OF THE TESTIS

There were 45 cases of malignant tumours of the testis treated in the radiation therapy department. While a general analysis showed no significant features, a racial comparison proved interesting, and revealed features not previously recorded.

There were 37 cases in Europeans (average age 37) and only 8 cases in Africans (average age 32) (Tables I and II). Berman,[5] in his review of malignancy among African mine workers on the Witwatersrand, found only 1 malignant testis among 270 cancers diagnosed, and this was in patients averaging 30 years in age. Oettlé,[6] in a review of malignancies found in Johannesburg Africans over a 3-year period observed only 2 malignant testes, when from a similar White population he would have expected 22.

Further analysis of the 8 cases in Africans showed that there were only 3 cases of malignancy in scrotal testes, the remaining 5 occurring in ectopic or undescended testes; whereas in Europeans there were 3 cases in abnormally situated testes, the remaining 34 being in scrotal testes. It is generally

accepted that about 10% of malignant testes occur in undescended or ectopic testes, whereas undescended and ectopic testes occur in about 0·2% of the male population. These figures correspond reasonably well with our European figures, but are at variance with our Bantu figures. It would appear that in the African the normally situated testis is not as prone to malignant changes as in the European.

The pathological picture was roughly similar in the two races, with seminomas predominating. There were 24 seminomas, 19 malignant teratomas and adenocarcinomas, and 2 chorionepitheliomas. The serological tests for syphilis were all negative, and there were no histories suggesting syphilitic infections.

All the African cases were advanced, several with skin involvement and malignant inguinal glands, and all had palpable abdominal glands. One case appeared clinically clear at the end of 2 years, but it is presumed that the remainder died within 1 year of treatment.

Treatment. The majority of testicular tumours were dealt with by limited surgery, generally orchidectomy and removal of the cord up to the internal ring, as the primary treatment. In cases of embryonal growths this was followed by radiotherapy of moderate dosage to the operative site and regional lymph nodes. All seminomas, whatever the palpable extent of the disease, were subjected to extensive irradiation of the operative site, the inguinal and pelvic lymph nodes on the affected side, and the para-aortic lymphatics at least to the level of the diaphragm. Tumour doses of the order of 3,000 r were well tolerated. More extensive disease occasionally necessitated irradiation of the mediastinum and the supraclavicular fossa, and in a few very advanced cases, treatment of the whole trunk by the 'moving-strip' technique was applied. Treatment was still useful in the most advanced cases; even extensive lung secondaries could be controlled for long periods by intravenous nitrogen mustard followed by thoracic irradiation with small doses.

CANCER OF THE PENIS

In contrast to malignancy of the testis, cancer of the penis was found more frequently in the African. Out of a total of 47 cases treated during the 10-year period, 34 were Africans, and 13 Europeans (Table I).

The average age of the Europeans was 66 and that of the Africans 50 (Table II). In most of the regions previously analysed, malignancy tended to occur almost a decade earlier in the African, and the difference of 16 years is the highest so far noted.

Oettlé[6] in his 3-year analysis of cancer in Johannesburg Africans found 8 cases of penile cancer, when he would have expected 3·6 cases for a similar White population. He also found that penile cancer represented 1·74% of all male cancer in urban areas, and 1·9% of all male cancers in rural areas. Wainwright and Raach[7] found that among the Durban Zulus, who do not practice circumcision, penile cancer represented 5·8% of all male cancers.

Closer analysis of the 34 African cases revealed some unusual features. Nine had been previously treated for syphilis, and there were 2 proved cases of lymphogranulomatosis. Several other patients gave histories of previous venereal infections, and it can be assumed that about half the African cases had had previous venereal disease.

In 8 of the Bantu cases the skin of the prepuce was the site of the primary lesion, and in 4 others the skin of the shaft of the penis, one of the latter having 2 separate malignant ulcers, one on the prepuce and one on the shaft. Thus approximately one-third of the cases among Africans could be classed as skin cancers. It has been shown previously that skin cancer in the African is not commonly found on exposed parts, and is usually grafted on pre-existing lesions such as scars of burns, syphilitic scars, keloids and chronic ulcers.

Circumcision as practised by the African witch-doctor on adolescents does not seem to confer much immunity, for several cases had undergone this type of circumcision. It is well known that the ritual circumcision is incomplete by surgical standards, and often results in scarring.

Racial comparison of the relative frequencies of cancer of the testes and penis thus shows a complete reversal, and it is difficult to speculate on the reasons for this. The skin sensitization in previous lesions probably plays a part in a small percentage of cases, but cannot account for the general preponderance of cancer of the penis in Africans. The lack of hygiene and the constant presence of smegma in the unsophisticated African suggests a possible carcinogen, and this aspect of the problem should be investigated, particularly in view of the relative frequency of carcinoma of the cervix in the African female.

CANCER OF THE PROSTATE

Since treatment of this condition is predominantly surgical, very few patients were referred for irradiation, and these have not been included in this report. It is generally agreed, however, that prostatic cancer is more frequent in Europeans than in Africans.

TUMOURS OF THE KIDNEY

There was a total of 106 kidney tumours, 61 in Europeans and 45 in Africans (Table I), which does not suggest any remarkable difference in the incidence of this disease in the two racial groups. However, the relative frequency of adenocarcinoma and nephroblastoma is markedly different in the two races.

Adenocarcinoma

Adenocarcinoma of the kidney is far more frequent in Europeans than in Africans (Table I), and affects males in two-thirds of cases. The average age of patients with renal cancer (excluding the nephroblastomas of childhood) is 56·4 years in Europeans and 43·2 years (more than a decade younger) in Africans (Table II).

There were no significant differences in staging in the various groups, approximately two-thirds of all patients being classified as 'late' or 'advanced' cases, and one-third as technically operable lesions. The majority of patients in all groups, however, had undergone some surgical procedure, nephrectomy when feasible, before irradiation.

Radiotherapy was given with the object of eradicating any residual disease, and was designed to deliver 5,000 r or more to the tumour, or to the operative site. This was achieved most satisfactorily with two opposed fields, each 15×10 cm. in area, subdivided by means of a 50%-transmission lead-rubber grid. A few cases treated on the right side developed duodenal ulcers, presumably attributable to the radiation; the ulcers could be controlled by simple drugs and mixtures. Though no useful statistics are available, the immediate results of the radiotherapy appear to be satisfactory.

Nephroblastoma

Nephroblastoma (Wilms's tumour) is more frequent in Africans, in whom it constitutes 71% of all kidney tumours, compared with only 20% in Europeans (Table I). There also seems to be a slight female preponderance, 63% of nephroblastomas in African children being in girls. All but 2 of the 44 cases appeared in the first decade of life, most of the patients being under 4 years of age, and no obvious difference was noted in the age of onset in the two racial groups. There seems to be no apparent explanation for the greater susceptibility to this tumour on the part of infant African girls.

The management of nephroblastoma, it is generally agreed, consists of surgery with either pre- or post-operative irradiation. The majority of tumours in this series were so large as to be technically inoperable when first seen, and in this type of case pre-operative irradiation was the preferred approach. Treatment was directed to the whole abdomen through two opposed fields, usually antero-posterior, occasionally lateral, delivering a total up to 2,500 r in about 4 weeks. A lead shield centred posteriorly over the remaining normal kidney served to reduce the dosage in this organ to somewhat less than half the average tumour dose, thus obviating the risk of late renal fibrosis and uraemia.

The tumours almost invariably responded dramatically to this procedure, continuing to regress for a period of 2 months or more and usually becoming small or barely palpable. In some cases the tumour was observed to get larger again after this period, and for this reason nephrectomy is advised 6 - 8 weeks after completion of radiotherapy. At this stage the operation is technically feasible, a normal-sized or moderately enlarged kidney being readily removed *in toto*, together with adherent peritoneum. Evidence of residual malignancy is nearly always obtained on histological examination of the operative specimen. This finding proves that radiation is rarely able to eradicate the disease completely, and that surgical removal is an essential part of the treatment. A number of post-operative recurrences by transperitoneal implantation of tumour cells were still observed after the combined approach, and in recent years we have followed all these procedures with intraperitoneal instillation of a suitable radiocolloid preparation (P-32 zirconium phosphate is our current choice).

The end-results are usually satisfactory, though no firmly established statistics are available. One patient is known to have survived, and is apparently cured, over 5 years, after unequivocal radiological evidence of lung secondaries, which were treated by a second course of radiotherapy directed to both lung fields.

CANCER OF THE BLADDER

Among the 164 cases of bladder carcinoma there were only 24 Africans, suggesting a distinctly greater incidence in Europeans, though the possibility, which cannot be excluded, that a number of African cases were too advanced or otherwise unsuitable for treatment may have biased this ratio. Males are more commonly affected than females, 82% of all cases being in men. (Table I.)

Among the European cases the commonest histological diagnosis was the transitional-cell carcinoma, which accounted for 48% of all bladder tumours; next most frequent were the papillary carcinomas (37%), while squamous-cell cancer constituted only 15% of the series. By contrast, squamous-cell carcinoma is by far the commonest malignant bladder tumour in Africans, accounting for 63% of our series, and confirming the findings of Kisner and Fine[8] at the Baragwanath Hospital in 1958. (Table I.) These authors found that this predominant squamous lesion was most frequently associated with bilharzial infestation, which must be considered an aetiological factor in these cases.

The average age of the African cases (46 years) was nearly 2 decades younger than the European average (65 years) (Table II).

The *management* of these patients was complicated by the fact that less than one-quarter of bladder tumours referred could be classified as reasonably 'early' cases. Nevertheless, some 80% of patients received one or other 'radical' therapeutic procedure such as radium implant, cobalt-60 as a central source in a Foley-type catheter, or conventional high-voltage X-ray therapy. None of these conventional methods of treatment have given satisfactory results, at least in the advanced bladder cancers presented in this series. In a preliminary follow-up survey there have in fact been no 5-year survivals of patients treated before 1954. In recent years, however, distinctly better results have been obtained in a series of selected early cases treated by means of 'permanent implants' of the relatively long-lived tantalum-182 isotope. This method, which will be described elsewhere, permits delivery of very large tumour doses with negligible local reactions and uniformly satisfactory tumour regressions.

SUMMARY

The cases of tumour of the genito-urinary system referred to the Radiotherapy Department of the Johannesburg Hospital during the 10 years 1949 - 58 are classified and analysed. The following is a summary of the conclusions:

1. The most prevalent tumour in our whole series was found to be carcinoma of the cervix, which accounted for over one-third of all cancer in African women. An unusual feature was the little difference in the average age incidence between the two racial groups; all other malignant disease analysed was found to occur in the African a decade earlier than in the European.

2. Treatment of cancer of the cervix was generally by means of radium and X-rays. In advanced recurrent cases intra-arterial chemotherapy combined with irradiation has given most encouraging results.

3. In contrast to carcinoma of the cervix, cancers of the ovary and of the body of the uterus were found to be remarkably infrequent in the African female by comparison with European cases.

4. Tumours of the testis were found to be relatively rare in the African, and in more than half the cases the malignant changes occurred in undescended or ectopic testes. It would appear that in the African the normally situated testis is not as prone to cancer as in the European.

5. Cancer of the penis was found to be relatively more frequent in the African, and previous venereal disease seemed to be a predisposing factor. Several cases were atypical in that the skin of the prepuce and penis seemed to be the primary site of the malignant lesion.

6. It is suggested that the presence of smegma, due to lack

of hygiene, is a probable aetiological factor in penile cancer, and possibly also in carcinoma of the cervix. It would appear that in the South African Bantu, control of venereal disease, circumcision and better hygiene would considerably reduce the number of penile cancers, and might also diminish the incidence of cervical cancer.

7. Amongst renal tumours, it was found that in Africans nephroblastomas were significantly more frequent than adenocarcinomas. In Europeans the reverse obtained, adenocarcinoma being far more prevalent than nephroblastoma.

8. Malignant bladder tumours were far more frequent in Europeans than Africans, being predominantly of the papillary and transitional types; those that did occur in Africans were generally squamous-cell cancers and often associated with bilharzia.

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